

# Measurement of Stretched Penile Length in Term Neonates at a Single Tertiary Care Centre of South India

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**Abstract:** Evidence from several studies has shown that the penile length varies among different populations of different racial/ethnic groups. Size abnormalities of the newborn external genitalia may be a pointer to some endocrine and genetic disorders. In this study we have prospectively measured the stretched penile length of all newborns at our hospital in an attempt to define normative data for full term neonates of our region. All live male neonates born at our hospital were enrolled into the study. Stretched penile length was measured from the pubic ramus to the tip of the glans penis using a digital Vernier Calliper. The measurements were taken within 48 hours of birth. Two consecutive measurements were taken and the average was recorded as the final measurement. The mean stretched penile length was  $2.63 \pm 0.35$  mm and the mean diameter of glans was  $1.04 \pm 0.09$  mm respectively. The penile length significantly varied with the length (height) of the neonate as expressed in cms. The taller the neonate, longer was the penis. Similarly, the mean penile length and the diameter of the glans was significantly different ( $p < 0.05$ ) for different gestational age. The stretched penile length of neonates significantly correlates with the gestational age and the length of the neonate.

**Keywords:** STRETCHED Penile Length, Smoothed Percentile Values, Gestational Age, Neonate, Length of the Neonate

## 1. Introduction

The differentiation of external genitalia into the male sex begins in the 7th week of gestation and is completed by 16–17 weeks. [1] Between the 4th and 7th weeks, the mesodermal mesenchyme migrates to the cranial aspect of the cloacal membrane to form the genital tubercle. [1] Under the influence of androgens, in males the mesoderm of the genital tubercle enlarges to become the corpora cavernosa and glans penis. The endoderm tubularizes in a proximal to distal direction to form the penile urethra. The ectoderm develops into the penile skin and prepuce, which begins formation at 8 weeks. [1, 2] The proximal crus of the corpora

cavernosa begin as separate structures spread apart under the ischium bilaterally and move medially under the pubis. The distal tips of the corpora cavernosa are capped by the glans penis, which is itself a continuation of the corpus spongiosum that surrounds the urethra.

Variations or abnormalities of the size of the penis in a newborn may point towards some endocrine and/or genetic disorders. One such abnormality that affects the penile length is micropenis, which is seen in congenital hypopituitarism, Noonan and Robinow syndromes [3, 4] and some chromosomal abnormalities such as Prader–Willi. [5] There exists evidence that the penile length varies among different racial/ethnic groups. [3–6] This makes it necessary to establish standard values for penile sizes in normal, healthy,

full-term neonates in each country and in its different regions. In this study we prospectively measured the stretched penile length of all newborns at our hospital in an attempt to define normative data for full term neonates of our region.

## 2. Materials & Methods

All live male neonates born at our hospital during the period 01-01-2017 to 31-7-2017 were enrolled. Written informed consent was obtained from the parents of all the included neonates. This study was conducted with the consent from the Institutional/University ethical committee KLESKFIEC/2016/015.

**Inclusion and Exclusion criteria:** All normal, term neonates with gestational age between 28 and 42 weeks were included in the study. Gestational age was calculated from the 1<sup>st</sup> day of the last menstrual period of the mother. Preterm neonates, low birth weight neonates, and those with gross congenital anomalies were excluded from the study.

**Examination and Measurements:** All examinations were performed in a warm and comfortable room by the same researcher and a trained neonatal nurse. All neonates were examined in a supine position with both legs in a flexed position. Stretched penile length was measured from the pubic ramus to the tip of the glans penis using a digital Vernier Calliper. The location of the tip of the glans penis was located by palpation. Similarly, the glanular diameter was measured using the same Vernier Calliper (Figure 1). The measurements were taken within 48 hours of birth. Two consecutive measurements were taken and the average was recorded as the final measurement.

**Statistical Analysis:** Results were presented as mean $\pm$ SD

for quantitative variables and were summarized by frequency (percentage) for categorical variables. The correlation of variables was tested by correlation analysis and backward regression analysis was used for prediction penile length and circumference. For the statistical analysis, the statistical software SPSS version 16.0 for windows (SPSS Inc., Chicago, IL, USA) was used. *P* values of 0.05 or less were considered statistically significant.



Figure 1. Vernier caliper.

## 3. Results

During the 7 months' study period a total of 500 male neonates were examined for penile length as well as diameter of the glans. All these neonates were term births with no obvious visible genital or other congenital anomalies. The mean penile length and diameter of glans was  $2.63 \pm 0.35$  mm and  $1.04 \pm 0.09$  mm respectively. The gestational age of the neonates ranged from 29 – 41 weeks (Table 1). The mean penile length and the diameter of the glans was significantly different ( $p < 0.05$ ) for different gestational age (Figure 2 and Figure 3).

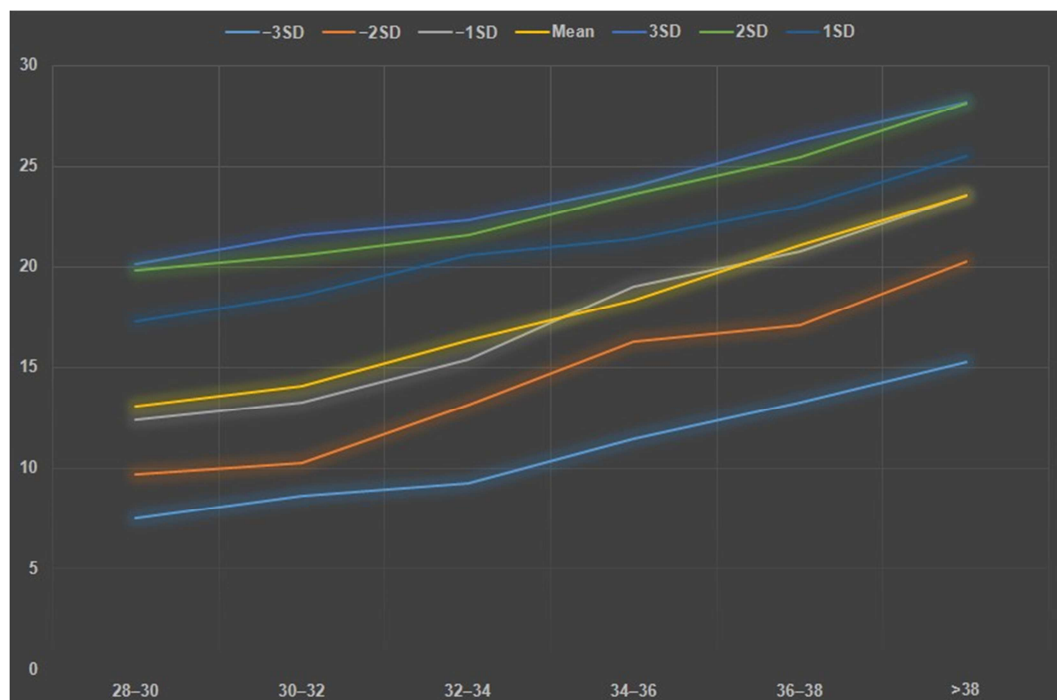
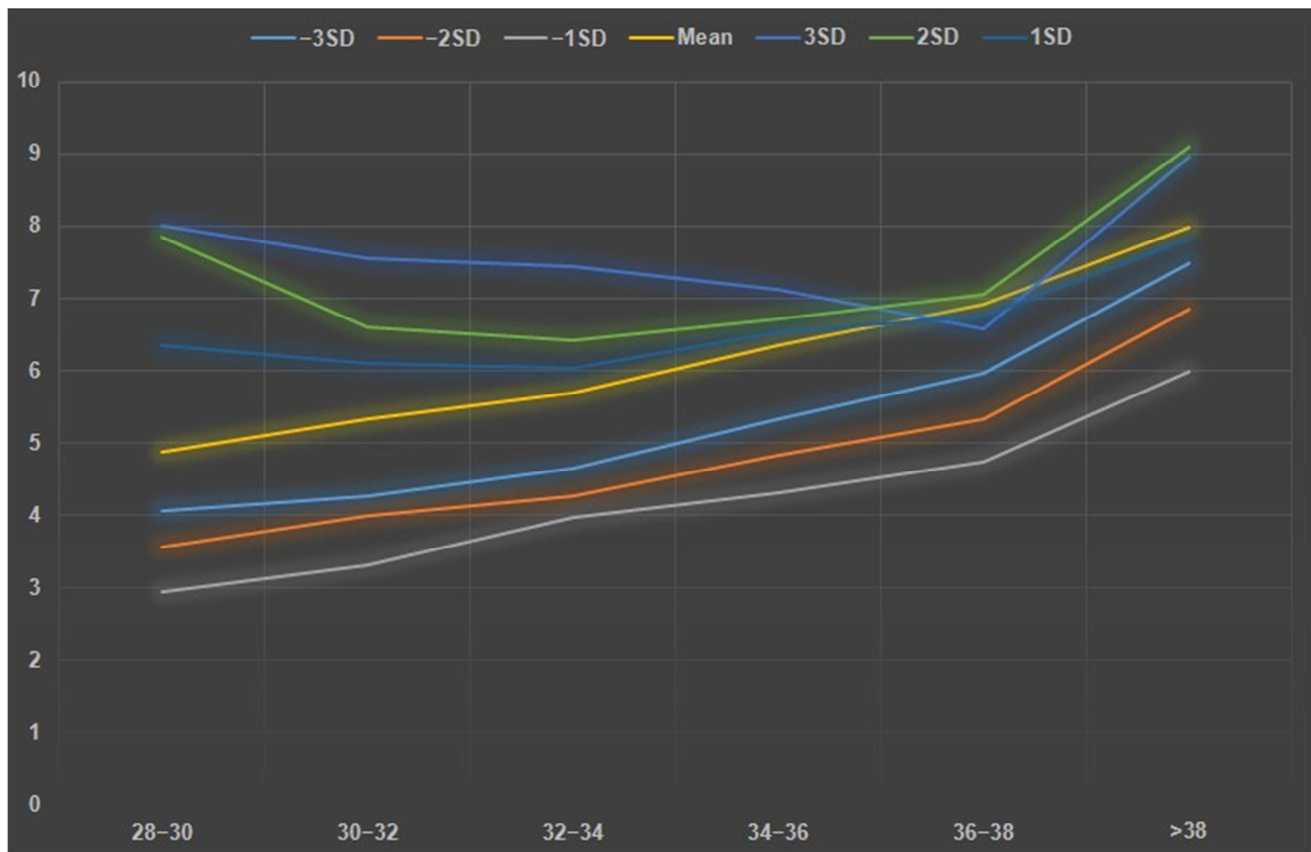


Figure 2. Mean and SD of penile length based on different gestational age.



**Figure 3.** Mean and SD of diameter of the glans based on different gestational age.

The penile length significantly varied with the length (height) of the neonate expressed in cms (Table 2). The taller the neonate, longer was the penis. The birth weight of the neonate did not correlate with the length of the penis in the neonate (Table 3). The mother's age had a significant influence on the neonates' penile length (Table 4).

**Table 1.** Correlation between Gestational Age, Penile length and Glans Diameter.

Gestational Age in Weeks	Parameter			
	Mean Penile Length (cm)	p-value	Mean Glans Diameter (cm)	p-value
≤ 31 (10)	1.59±0.32	0.0008*	0.65±0.29	0.0229
32 - 35 (43)	1.96±0.09	0.0001*	0.90±0.04	0.0001*
36 - 39 (332)	2.61±0.18	0.0001*	1.04±0.02	0.0001*
≥ 40 (115)	3.02±0.11	0.0001*	1.14±0.04	0.0001*

\*The result is significant at  $p < 0.05$ .

**Table 2.** Correlation of Baby length (cm) with Penile Length and Glans diameter.

Baby Length (cm)	Parameter			
	Mean Penile Length (cm)	p-value	Mean Glans Diameter (cm)	p-value
≤ 41 (30)	1.79±0.24	0.0001*	0.80±0.20	0.0001*
41 - 45 (80)	2.23±0.15	0.0001*	0.98±0.04	0.0001*
46 - 50 (344)	2.73±0.17	0.0001*	1.06±0.03	0.0001*
≥ 50 (46)	3.11±0.13	0.0001*	1.18±0.02	0.0001*

\*The result is significant at  $p < 0.05$ .

**Table 3.** Correlation of Birth Weight (Kg) with Penile Length and Glans diameter.

Birth weight in Kg.	Parameter			
	Mean Penile Length (cm)	p-value	Mean Glans Diameter (cm)	p-value
≤ 1.9 (46)	2.65±0.35	0.4945	1.05±0.07	0.5748
2 - 2.4 (97)	2.66±0.32	0.4365	1.05±0.07	0.2919
2.5-2.9 (212)	2.63±0.33	0.7799	1.04±0.09	0.3055
≥ 3 (145)	2.60±0.39	0.5721	1.03±0.11	0.1603

**Table 4.** Correlation of Mothers age with Penile Length and Glans Diameter.

Mothers Age (years)	Parameter			
	Mean Penile Length (cm)	p-value	Mean Glans Diameter (cm)	p-value
18 – 24 (332)	2.45±0.30	0.0001*	1.00±0.09	0.0001*
25 – 29 (132)	2.92±0.07	0.0001*	1.10±0.02	0.0001*
≥30 (36)	3.14±0.14	0.0001*	1.20±0.01	0.0024*

\*The result is significant at  $p < 0.05$ .

The mother's weight (Table 5), height (Table 6), number of pregnancies (Table 7), and pregnancy associated hypertension (Table 8) did not significantly affect the penile length of the neonate.

**Table 5.** Correlation of Mother's Weight with Penile Length and Glans Diameter.

Mother's weight (Kg)	Parameter			
	Mean Penile Length (cm)	p-value	Mean Glans Diameter (cm)	p-value
≤ 50 (144)	2.62±0.35	0.6814	1.05±0.08	0.7643
51 – 60 (270)	2.65±0.32	0.1672	1.05±0.07	0.1492
61 – 70 (66)	2.55±0.44	0.1868	1.01±0.18	0.3788
≥71 (20)	2.62±0.37	0.2871	1.05±0.08	0.3275

**Table 6.** Correlation of Mother's Height (Kg) with Penile Length and Glans Diameter.

Mother's Height (cm)	Parameter			
	Mean Penile Length (cm)	p-value	Mean Glans Diameter (cm)	p-value
≤ 150 (143)	2.65±0.32	0.0688	1.05±0.07	0.0482
151 – 160 (335)	2.64±0.34	0.2906	1.05±0.09	0.9880
≥161 (22)	2.30±0.52	0.6789	0.93±0.22	0.6835

**Table 7.** Correlation of Number of Pregnancies with Penile Length and Glans Diameter.

Number of Pregnancies	Parameter	
	Mean Penile Length (cm)	Mean Glans Diameter (cm)
1 (233)	2.62±2.6	1.04±0.09
2 (193)	2.65±0.35	1.05±0.10
3 (54)	2.55±0.38	1.03±0.08
≥4 (20)	2.61±0.32	1.04±0.06

**Table 8.** Correlation of Pregnancy Induced Hypertension with Penile Length and Glans Diameter.

Comorbidity	Parameter	
	Mean Penile Length (cm)	Mean Glans Diameter (cm)
Pregnancy Induced Hypertension		
YES (70)	2.56±0.35	1.03±0.07
NO (430)	2.64±0.35	1.05±0.10
	p=0.0768	p=0.1081

## 4. Discussion

Physical examination of a neonate which includes the inspection of the genital area is a very important part of the assessment of a new-born. Measurement of the penile size is considered important as it is an indicator of the hypothalamic pituitary axis. Abnormalities in the penile size may be due to inadequate androgen exposure during foetal development. [7] Penile measurement also contributes towards the diagnosis of the underlying genetic disorders [8] and is important in procedures, such as circumcision, as well. [9]

Micropenis has been defined as a small sized penis that is 2.5 SDs below the mean penile length without epispadias or hypospadias. [10] The accuracy of penile length

measurement and cut-off for the definition of micropenis is of great importance, which is commonly missed in early physical examination of the new-born. Stretched penile length (SPL) is commonly available on nomograms, based on gestational age, weight, and height. [11] Penile length (PL) values also vary depending on the gestational age, prematurity of the newborn [12], as well as in different ethnicities. [13] Measurements of PL in neonates will help in developing the correct nomograms which represent the local populations.

We have used the digital vernier caliper in this study, to measure the penile length as well as the diameter of the glans. The accurate measurement of penile length is important in children especially with abnormal genital development, e.g. micropenis, microphallus, buried penis and webbed scrotum.

[14-16] Ozbey et al [16] described a simple and effective method for measuring penile length in neonates and infants. A 10-mL disposable syringe was used in a modified fashion by removing the needle-bearing end and introducing the piston into the cut end. The flanged end was then placed over the penis to be measured, firmly pressed onto the pubis and the piston partially withdrawn, causing suction. This drew the penis into the injector, partly erect, and excluded the prepubic fat. The length of the penis was then read from the attached scale when the suction was optimal.

Chikani et al [17] reported on the normative values of stretched penile length in apparently healthy term Igbo newborn males in South eastern Nigeria and its relationship with gestational age, birth weight and birth length. The stretched penile length was measured in eight hundred and eleven apparently healthy term male neonates within the first 72 h of life. The mean stretched penile length of term newborns was  $3.46 \pm 0.44$  cm. The lower and upper limits ( $\pm 2.5$  SD) were 2.36–4.56 cm. Stretched penile length correlated positively with birth length and birth weight ( $r=0.343$ ,  $p=0.001$ ;  $r=0.229$ ,  $p=0.001$ ).

Soheilipour et al [18] reported on stretched penile length (SPL) values and cut-off level of micropenis in term and preterm Iranian neonates. Among a total of 587 neonates, 203 neonates were born term and 384 preterm. Mean  $\pm$  SD of their SPL was  $22.48 \pm 3.34$  mm;  $25.92 \pm 1.54$  mm in term and  $20.66 \pm 2.50$  mm in preterm infants ( $P=0.001$ ).

## 5. Conclusion

The authors concluded that The SPL in male neonates correlated with gestational age and birth weight. Our study too showed that the SPL significantly correlated to the gestational age, but did not correlate with birth weight. Our study clearly shows an association of SPL with anthropometric variables of new-borns and that SPL can be very variable in each population; thus, it is essential to refer to the normal value that is defined for a specific population and the results of such studies can help physicians and researchers in this respect.

There are several limitations of our study including the small number of neonates examined over a short period of time. Our hospital being a private hospital, the patients attending our hospital usually come from financially middle class, hence a very selective population. There could be several factors that we have not taken into consideration, which could have had a bearing on our study. To conclude our study has clearly shown that the stretched penile of neonates is significantly associated with the gestational age and the length of the neonate.

## Conflict of Interest

All the authors do not have any possible conflicts of interest.

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